Original Article

Determinants of Atopic Dermatitis among Children in a General Out-Patient Clinics of a Tertiary Hospital in North Central, Nigeria

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Abstract

Background: Atopic dermatitis (AD) is a chronic, inflammatory, and itchy skin condition that develops in early childhood in the majority of cases. **Aim:** The objective of this study is to determine factors associated with atopic dermatitis among children aged 6 months to 14 years seen at the General Out-Patients Clinics of a tertiary hospital in north central Nigeria as well as predictors of having AD. **Patients and Methods:** This was a descriptive cross-sectional study of 490 eligible children recruited using the systematic random sampling technique. The data collected were analyzed using statistical package for social sciences, version 22. Descriptive and inferential statistics was performed to determine the relationship between independent variables and having AD. **Results:** The factors significantly associated with AD from this study include: male sex (χ = 4.78, P = 0.029), Being in nursery school (χ = 77.60, P = 0.000), Nupe ethnicity (χ = 49.06, P = 0.000), mothers and fathers Educational level (χ = 27.80, P = 0.000), having personal or family history of atopy (χ = 31.30, P = 0.000). After all variables that are significant was adjusted; Nursery level of education (OR = 4.076, 95% CI = 1.679-9.891, P = 0.002), Mother's Level of education (OR = 0.664, 95% CI = 0.442-0.998, P = 0.049), and personal or family history of atopy (OR = 5.585-E12, 95% CI = 5.585-E12-5.585-E12, P = 0.000) were independent predictors of AD. **Conclusion:** Our data suggest that AD has a specific pattern of inheritance in children and this was predicted by: nursery level of education, mother's level of education, and family or personal history of atopy. Knowledge of this will provide a better caring strategy for predicting and preventing AD earlier in at risk children.

Keywords: *Atopic dermatitis, children, determinants*

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Introduction

Atopic dermatitis (AD), also called atopic eczema, is a common chronic or recurrent inflammatory skin disease and affects 15–30% of children and 2–10% of adult's worldwide.[1,2]

Theories concerning causation of AD had centered mainly on interplay between the skin barrier and immunological factors. The immunological hypothesis focuses on an imbalance in T helper cells such that there is a predominance of Th2 cells rather than Th1. This results in an increase in immunoglobulin E (IgE) through a pathway involving activation of interleukins.[3]

In the skin barrier hypothesis, atopic dermatitis is associated with filaggrin gene mutations. Filaggrin is a protein important in maintaining the integrity of the epidermis by binding keratinocytes together. Thus skin barrier dysfunction occurs if there is a defect in filaggrin, which leads to water loss from the skin. As the skin becomes drier, allergens enter more easily, resulting in allergic sensitization.[4]

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There are different AD patterns: in infants, the face (cheek) is typically involved, while older children and adults often experience rashes on the knees or elbows (often in the folds of the joints), on the backs of the hands or on the scalp.[1,5,6]

However, early childhood AD is often the initial indication that a child may later develop asthma and/or allergic rhinitis (hay fever).[6]

There is no laboratory "gold standard" for the diagnosis of AD. The diagnosis of AD is based on a constellation of signs and symptoms.[2] Several diagnostic criteria have been proposed, but at present the two most reliable are the 2003 revision by the American Academy of Dermatology of the Hanifin-Rajka criteria, and those by Williams revised in 2005.[7,8]

AD poses a significant burden on healthcare resources[2] and patients' quality of life (mainly because it results in school absenteeism and emotional stress in children,[9] sleep deprivation due to itchiness, anxiety, anger, or depressive symptoms,[10] employment loss, and financial costs.[6] In addition, AD negatively affects patients' social life, lowers their academic achievement, and sometimes causes patients to think about committing suicide.

Among the most extensively studied risk factors for AD, one could cite family history and atopy, as the commonest. Others are household exposure to allergens and irritating substances, early antibiotic use, type of delivery, infectious, and parasitic diseases.[11-14]

This study was undertaken to determine the determinants of atopic dermatitis among children aged 6 months to 14 years presenting in the General Out-Patients Clinics of a tertiary hospital in north central Nigeria as well as predictors of having AD, so as to provide strong evidence for the prevention and control of AD in school children.

Materials and Methods

This hospital-based cross-sectional study was carried out in the skin clinic of the GOPC of the department of Family Medicine Department, at a tertiary health facility in north central Nigeria, for a period of three months from April to June, 2017.

Sample size calculation was determined using the Kish Leslie formula for cross-sectional studies:

$n = Z^2pq/d^2$[15]

Using a prevalence of 5.5%, found earlier in Calabar by Olayinka *et al*.[16] this gave a sample size of approximately = 499.

Given that N (the entire population of pediatric patient seen in GOPC on a monthly basis) is <10,000, the required sample size will be smaller. Final sample estimate (nf) = n/(1 + (n/N)

Where:

n = the desired sample size when population is more than 10,000 = 499.

N = the estimate of the population size, that is the population frame = 3501.

Hence $n_f = 499/\{1 + (499/3501)\}$

$n_f = 437$

Adjusting for non-response with an attrition rate of 10%, therefore the minimum sample size:

$N = n_f/1\text{-}NR$

N = minimum sample size

$n_f = 437$

NR = non-response rate = 0.10

N = 437/1- 0.10 = 486

N = 486

This was rounded up to 490. Therefore, a minimum of 490 subjects were recruited for this study.

Using a population frame of 3501, the sampling interval (K) employed was = 3501/490 = 7 to make up to the required 41 children per week.

The first patient was picked by simple random sampling among the first seven patients. This was done by writing one to seven each on a similar piece of paper which was then folded separately, mixed thoroughly in a container from where the first child was picked randomly by balloting. The participant (or care-giver) that picked the number one and found eligible was selected as the first study subject. Thereafter, the remaining subjects were selected through systematic sampling, at fixed intervals of every seventh number. Identification numbers was placed on all selected participants' record card to avoid repeat selection. The process was repeated each of the clinic days. The participants were screened and those who met the inclusion criteria were recruited for the study after signing a written consent (or assent authenticated by thumb printing in the case of those who can neither read nor write in English language).

The hospital ethical committee approved the study protocol. After taking an informed written consent from the parents of every patient, all the patients were enrolled and data collection was through the use of a study proforma. Age, gender, and socioeconomic status were obtained from respondents. Detailed history was

taken and a thorough general examination done with special emphasis on features of atopic dermatitis.

Diagnosis of atopic dermatitis was based on the Hanifin and Rajka criteria.[7,8,14] The presence of three major and three minor criteria was required to make a diagnosis of atopic dermatitis. The Three-Item severity (TIS) score was used as an objective measurement of the severity of AD. It has a total score of 9; a score of less than 3 indicates a mild form, a score of 3-6 indicates a moderate form, while a score greater than 6 indicates a severe lesion. The TIS score was chosen because it is quick, can be scored in different representative areas, and correlates well with scoring atopic dermatitis (SCORAD) which is a well-validated tool for monitoring AD.[7]

Inclusion criteria are: Children aged 6 months to 14 years, Respondent or their care-givers capable of providing complete information in the data collection form. Exclusion criteria includes: Patients with AD who have any associated congenital skin disorders, secondary infections, immunodeficiency disorders or drug rashes and respondents or their care-givers unwilling to participate in the study.

Descriptive analyses were conducted to examine the distribution and frequencies of patient/parent socio-demographic characteristics. Chi square was used to test individual association between the variables, while significant independent variables were jointly analyzed in a multivariate logistic regression. A *P* value of < 0.05 was set to determine significance level, while estimate of the odds ratio (OR) and 95% confidence intervals (CIs) for association between independent variables and AD symptoms. Statistical package for social sciences, version 22 (SPSS 22 Chicago, Illinois, USA) was used to analyze the data.

Results

The distribution of respondents' socio-demographic characteristics have been previously described and is summarized here.[17] The male to female ratio of the patients was 0.98: 1, mean age was 5.73 (±3.51) years with 225 (45.9%) in the 5–9 year age group and 73.3% at primary level of education. The majority 390 (78.6%) of study participants were Muslims and Nupe tribe accounted for 346 (70.2%). There were 490 children in this study 48 (9.8%) had AD and the remaining 442 (90.2%) did not have AD.

Table 1 shows that when having AD, was cross-tabulated with certain determinants, the factors significantly associated with AD from this study include: male sex (χ = 4.78, *P* = 0.029), Being in nursery school (χ = 77.60, *P* = 0.000), Nupe ethnicity (χ = 49.06, *P* = 0.000), mothers and fathers Educational level (χ = 27.80, *P* = 0.000), having personal or family history of atopy (χ = 31.30, *P* = 0.000).

Table 2 shows that the odds of having AD were statistically significantly elevated (p, <0.05) in male sex (OR = 4.844, *P* = 0.028), Being in nursery school (OR = 66.363, *P* = 0.000), Nupe ethnicity (OR = 42.023, *P* = 0.000), mothers educational level (OR = 23.453, *P* = 0.000) and fathers Educational level (OR = 28.675, *P* = 0.000), having personal or family history of atopy (OR = 131.020, *P* = 0.000).

Discussion

The common determinants from this study were; male gender, being in nursery school, being of Nupe tribal extraction, and having tertiary educated parents. Other notable risk factors include; previous personal or family history of atopy

AD in this study was more common in males (12.8%) than in females (6.9%), despite almost equal number of males and females in the study. This finding is similar to what has been documented by Yung *et al*.[18] Similarly, a study done by Kalu *et al*.[19] attested to the fact that cases of AD occurred more commonly among males than females. Generally for AD, a male dominance is observed in the younger age groups, followed by no sex differences after puberty and in adulthood, when it is said to be more common in women.[20] This is in agreement with studies done in Egypt.[21]

Children in nursery school were also found to be statistically at a higher risk of AD compared to older age group (OR = 66.4; *P* value = 0.000).This finding was similar to previous studies where AD was found to be more common in younger aged children and the age of onset was less than 5 years (nursery school age). The literature suggests that atopic dermatitis was characterized by a chronic, relapsing dermatitis that was pruritic and begins in the first 5 years of life in 90% of patients.[22] The reason why AD is more common among nursery school children is not known, perhaps issues relating to the play environment or school might be responsible. Unfortunately, this study was not designed to test that.

Majority of the patients with AD were of Nupe ethnicity and this was not surprising because Bida is a town with predominantly Nupe people. To my knowledge no study among Nupe tribe has been done to look at ethnicity as causation of AD. Even in advanced societies we could not identify such a study. Perhaps some other, not yet identified, factors may be responsible for this.

Table 1: Determinants of atopic dermatitis

Variables	Atopic dermatitis		Total *n* (%)	χ^2	*P*
	Present *n* (%)	Absent *n* (%)			
Age group (years)					
6mo-4.99	23 (12.6)	160 (87.4)	183 (100.0)	2.87	0.238
5-9	17 (7.6)	208 (92.4)	225 (100.0)		
10-14	8 (9.8)	74 (90.2)	82 (100.0)		
Sex					
Male	31 (12.8)	212 (87.2)	243 (100.0)	4.78	*0.028
Female	17 (6.9)	230 (93.1)	247 (100.0)		
Child Level of education					
Nursery	32 (31.4)	70 (68.6)	102 (100.0)	77.60	*0.000
Primary	10 (2.8)	349 (97.2)	359 (100.0)		
Secondary	6 (20.7)	23 (79.3)	29 (100.0)		
Ethnic group					
Hausa	4 (17.4)	19 (82.6)	23 (100.0)	49.06	*0.000
Igbo	3 (13.0)	20 (87.0)	23 (100.0)		
Nupe	22 (4.1)	323 (95.9)	345 (100.0)		
Yoruba	6 (30.0)	14 (70.0)	20 (100.0)		
Others	13 (26.6)	66 (73.4)	79 (100.0)		
Religion					
Christianity	15 (14.3)	90 (85.7)	105 (100.0)	3.05	0.081
Islam	33 (8.6)	352 (91.4)	385 (100.0)		
Level of education of mother					
None	15 (5.2)	272 (94.8)	287 (100.0)	27.80	*0.000
Primary	3 (11.1)	24 (88.9)	27 (100.0)		
Secondary	10 (10.4)	86 (89.6)	96 (100.0)		
Tertiary	20 (25.0)	60 (75.0)	80 (100.0)		
Level of education of father					
None	11 (4.3)	247 (95.7)	258 (100.0)	31.24	*0.000
Primary	1 (7.1)	13 (92.9)	14 (100.0)		
Secondary	6 (7.7)	71 (92.3)	77 (100.0)		
Tertiary	30 (21.6)	109 (78.4)	139 (100.0)		
Mother's Occupation					
Artisan	0 (0.0)	7 (100.0)	7 (100.0)	2.85	0.723
Business	8 (12.7)	55 (87.3)	63 (100.0)		
Civil servant	7 (7.0)	93 (93.0)	100 (100.0)		
Farmer	0 (0.0)	4 (100.0)	4 (100.0)		
House wife	32 (10.5)	273 (89.5)	305 (100.0)		
Unemployed	1 (9.1)	10 (90.9)	11 (100.0)		
Father's occupation					
Artisan	0 (0.0)	11 (100.0)	11 (100.0)	5.50	0.240
Business	23 (12.8)	156 (87.2)	179 (100.0)		
Civil servant	14 (7.5)	172 (92.5)	186 (100.0)		
Farmer	9 (8.7)	95 (91.3)	104 (100.0)		
Unemployed	2 (20.0)	8 (80.0)	10 (100.0)		
Personal or family history of atopy					
No	23 (4.9)	442 (100.0)	465 (100.0)	242.59	*0.000
Yes	25 (100.0)	0 (0.0)	25 (100.0)		

*Significant: *P*= 0.004

Most of the patients with AD were born to parents with tertiary education and were civil servants. The reason for this finding was probably because educated parents had a higher purchasing power and could afford manufactured refined foods, which contain allergens that could have induced AD in their children. There are three federal institutions (Federal Medical Centre, Federal Polytechnic, National Cereal Research Institute) in the Bida community and a state-owned tertiary institution. Most of the participants in this study are likely to

Table 2: Multiple regressions of significant parameters

Variables	OR	95%CI	*P*
Sex	2.030	0.778-5.297	0.148
Child's educational level	3.615	1.494-8.746	*0.004
Religion	0.651	0.215-1.977	0.449
Ethnicity	0.620	0.383-1.002	0.051
Mother's educational level	0.879	0.468-1.651	0.688
Father's educational level	0.618	0.328-1.163	0.136
Personal/family history of atopy	5.585E-012	5.585E-012	*5.585E-012

*Significant: $P = 0.004$

be children of educated parents who work in these establishments.

Another explanation for the higher prevalence of AD among children with higher socioeconomic status is the "hygiene hypotheses" where reduced exposure to infectious agents in early childhood increases susceptibility to AD.[6,23] Since the study population was from a tertiary health center, it is expected to have more educated people with better health seeking behaviors. While these have been documented previously by earlier studies especially in developed countries,[24,25] it is important to note that the trend is also becoming common in developing countries like Nigeria.

This study also observed that previous personal or family history of atopy was significantly associated with the development of AD (OR = 131.0; *P* value = 0.000) which was earlier documented by Thakur *et al*.[25] Parental atopy was significantly associated with the manifestation and severity of early onset AD in children, which has been attributed to the role of genetics in the development of AD.[1]

Several genes have been identified in atopic dermatitis on chromosome 5. Furthermore, concordance rate in monozygotic twins was about 70%. These genes are said to encode cytokines produced by T lymphocytes: type 1 and 2 T helper cells. The cytokines produced are interleukins 4,5,12, and 13. Knowledge of this has helped in the management of these patients and might help in finding cure for the disease.[1,6]

This study has some potential limitations. Firstly, our analyses are based on cross-sectional data which may be subject to recall bias. Secondly, it was conducted from April to June rather than throughout the year, the prevalence of AD may not have been perfectly represented, and lastly, the defined determinants are only at a degree of association and not causation.

Conclusion and recommendation

Our data suggest that AD has a specific pattern of inheritance in children and this was predicted by: nursery level of education, mother's level of education, and family or personal history of atopy. Knowledge of this will provide a better caring strategy for predicting and preventing AD earlier. Parents and teachers need to understand this determinant in order to teach children about AD and to adapt to living with their difficulty.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

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